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EVALUATION OF THE EFFECTIVENESS OF THE USE OF DISTANCE TECHNOLOGIES FOR TEACHING INORGANIC CHEMISTRY AT SCHOOL

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Abstract

The article presents the results of assessing the effectiveness of distance learning of inorganic chemistry for students from school 37 in Nur-Sultan. The research was carried out at the expense of the authors' own funds. The authors partially proved the validity of the model for organizing distance learning of students and the positive impact of its pedagogical conditions. The carried out diagnostics of the effectiveness of the organization of distance learning allows to increase the level of education of students. The use of distance learning technologies gives positive results in the preparation of pedagogical personnel - chemistry teachers and in teaching students, which is very important for the development of the educational process in our country. The proposed model for organizing distance learning in inorganic chemistry at school is characterized by the integrity and interdependence of the following blocks: target, methodological, organizational, procedural, diagnostic, and the effectiveness of the results.

Keywords: distance learning, inorganic chemistry, effectiveness, distance technologies, the monitoring,chemical experiment, students.

Introduction

Considering the school as an educational organization that performs, in addition to teaching, cultural, educational, social functions, we can distinguish two groups of factors that determine the characteristics of the educational process. External factors include the type of educational institution, the sociocultural situation, the location of the school, the availability of institutions of additional education and culture. Internal factors determine the features of the educational process of the studied school. These include the number of students, affecting the development of communicative skills of students, the level of motivation to learn, forms, methods, techniques of organizing the educational process; a high degree of dependence on the level of qualifications of teachers, the degree of accessibility of educational resources, affecting the openness of an educational institution and the level of organization of educational

work. Studying the pedagogical possibilities of distance learning leads to the idea of using distance learning to solve objectively existing problems caused by these factors. Studying the forms, methods, and technologies of organizing distance learning allows us to define distance learning of inorganic chemistry at school as a special type of educational activity carried out by means of telecommunication technologies, included in the educational process, used by students to master the educational program in inorganic chemistry and carried out mainly in synchronous mode, in video conferencing format. Distance learning in this form

- solves problems caused by the small number of students: creates the conditions for communication of the subjects of the educational process, increases motivation for learning, provides a variety of forms, means, teaching methods [1];

- solves the problem of teaching staff, as it provides students with access to the lessons of the best chemistry teachers, including research or technical teachers Universities, which contributes to their intellectual development, improving results in the subject, the formation of pupils Information and communication technology (ICT) competence [2];

- provides schools with access to world educational resources, increases the openness of the educational institution, takes it to a new level in the organization of the educational process [3].

The need to organize distance learning for students in a school has led us to build a model for organizing distance learning for inorganic chemistry in a school, characterized by the integrity and interdependence of the following blocks: target, methodological, organizational, procedural, diagnostic, and effective. We adhere to the following hypothesis: distance learning is more effective than the traditional format.

Materials and methods of research

The material for the research was statistically processed data on pupils' assessments during training.

The object of the research was the participants in the educational process in the distance learning of inorganic chemistry at school. It is important to understand that the teacher, students, tutors are the main figures [4]. When teaching inorganic chemistry, it is necessary to clearly distinguish between the functions of a teacher and a tutor.

The functions of a teacher in a distance learning form are significant changes. Teacher’s primary task is to prepare a distance learning course based on existing sources or original inventions of thematic sections. In design an electronic version of the course, experts in the field of information technology can help him (the first teacher’s task) [5].

The second most important pedagogical task, as mentioned above, is the management of educational and cognitive activity of students in the framework of the content of education, which is predetermined by the tasks of training and the development of their intellectual strengths and abilities [6].

The third most important task of a teacher is to control the knowledge of students. This traditional teaching task in distance learning solved during the development of test tasks of the current and final control, the procedure for implementing the testing process can be carried out both by the teacher and the tutor with the provision of results to the teacher.

Thus, the main tasks of a teacher in DE are:

- learning course development;
- Instruction, manual development;
- advising students on the subject and helping them in difficult situations;
- control of learning results.

Student functions. The learning course in the DE system is often focused on independent study, so for the student the learning process includes two mandatory components:

- individual work involving the use of various forms of learning (training) materials and educational and technological tools (software and computer products, audio / video recordings, etc.);
- dialogue with the tutor, tutor and other students [7].

In the first case, the instruction manual is a training manual. But a tutor can play a significant role, enriching the student's potential with methods, forms, types and techniques of educational knowledge that are still unknown to him or helping to apply the already known methodological capabilities in new conditions. In the second component of the educational process, it seems necessary to pay special attention to the contacts of students between themselves. If in-person contacts between group members are impossible, then each of them should be provided with the opportunity to access information about all the others both for interaction with each other in solving educational problems, and for informal contacts [8].

As a rule, in the practice of a tutor, the following main functions are distinguished, which determine his duties:

- assistance to students in their professional self-determination;
- organizational management of the educational and cognitive activity of the student; - development of educational and cognitive potential of students;
- assistance to students in the correct and effective use of educational and methodological support of the course;
- conducting group and individual consultations on the use of educational and methodological support for the course;
- monitoring the implementation of the learning process schedule by students;
- providing educational and assistance in the implementation of social contacts between students [9].

Additionally, there are usually two functions of teacher and tutor:

• Facilitator – teacher-developer of teaching materials. He / She helps a group of people to work together better;

• Invigilator - specialist in methods of monitoring learning results. An exam invigilator, exam proctor or exam supervisor is someone who is appointed by the

examination board and services for maintaining the proper conduct of a particular examination in accordance with the exam regulations [10].

Author contributions. The authors' scientific contribution to methodological science consists in substantiating the need for distance technologies in the educational process in order to immerse schoolchildren in the educational environment through an independent search for educational Internet resources and the conscious use of interactive Internet services for the study of inorganic chemistry, the principles of distance learning in inorganic chemistry are disclosed. Development and results are useful for all chemistry teachers.

Methods. The experiment was conducted at school 37 in the city of Nur Sultan. Two classes are involved, called 7 «A» and 7 «B». To determine the quality of assimilation of materials on the 9 topics with tests and tasks. Tasks and tests were of medium difficulty. The results were evaluated on a 5-point scale. Each test had a closed and open type response. The reliability of the results is confirmed by the presence of processed experimental data by the statistical method. The experiment was conducted in two classes A and B: - Class A - studied a section of inorganic chemistry called solutions in the traditional form. There were 34 students in class. - Class B - studied a section of inorganic chemistry called solutions in the distant form. There were 32 students in class.

Results

During the experiment, the following students' results were revealed (table 1). In distance learning, the average marks of students were higher and fluctuated within 4.1-4.7.

Table 1. Average results A and B classes

№	Topics name	Class	Average result – traditional learning	Average result – distant learning
1.	Introduction to Chemistry. Pure substances and mixtures	A	4,7	-
		B	-	4,6
2.	Substance changes	A	4,4	-
		B	-	4,6
3.	Atoms. Molecules. Substances	A	4,8	-
		B	-	4,3
4.	Air. Combustion reaction	A	3,7	-
		B	-	4,6
5.	Chemical reactions	A	4,2	-
		B	-	4,6
6.	Periodic Table of the Chemical Elements	A	4,1	-

		B	-	4,5
7.	Relative atomic mass. The simplest formulas	A	4,4	-
		B	-	4,2
8.	Chemical elements and compounds in the human body	A	4,4	-
		B	-	4,1
9.	Geologicalchemicalcompounds	A	3,7	-
		B	-	4,7

The average value maximum result was calculated according to the principle: ∑x/n=average (x - the sum of all ratings divided by the n - sum of people in the class). A graphical representation of the averaged results of groups A and B are presented (figure 1).When studying 9 topics, the maximum marks were achieved when studying 1 topic in both groups.

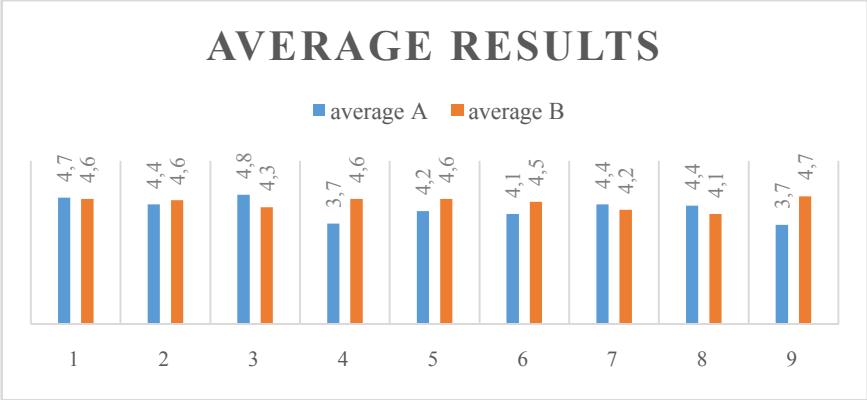

Figure 1 - Average results A and B classes

Table 1 and figure 1 show that topics 1, 2, 3, 7, 8 are better mastered in the traditional format. 4, 5, 6, 9 topics are better mastered in a distance format.

Maximum and minimum scores were used to compare the results (table 2, 3). According to table 2, the maximum results were achieved with distance learning "Substance changes" and "Chemical reactions".When studying the topic of transformation of substances, the students of group A in the offline learning format showed the lowest results.

Table 2. Maximum results A and B classes.

№	Topics name	Class	Maximum result traditional learning	Maximum result –distant learning
1.	Introduction to Chemistry. Pure substances and mixtures	A	4,4	-
		B	-	4,9
2.	Substance changes	A	3,8	-
		B	-	5,0
3.	Atoms. Molecules. Substances	A	4,8	-
		B	-	4,7
4.	Air. Combustion reaction	A	4,2	-

		B	-	4,9
5.	Chemical reactions	A	4,3	-
		B	-	5,0
6.	Periodic Table of the Chemical Elements	A	4,3	-
		B	-	4,9
7.	Relative atomic mass. The simplest formulas	A	4,5	-
		B	-	4,4
8.	Chemical elements and compounds in the human body	A	4,6	-
		B	-	4,3
9.	Geologicalchemicalcompounds	A	4,1	-
		B	-	4,9

The lowest result was observed in distance learning of the topic «Chemical elements and compounds in the human body» (table 3). In group A, low rates are observed when studying topics 1, 4, 9.

Table 3. Minimum results A and B classes.

№	Topics name	Class	Minimum result – traditional learning	Minimum result – distant learning
1.	Introduction to Chemistry. Pure substances and mixtures	A	3,2	-
		B	-	4,3
2.	Substance changes	A	3,6	-
		B	-	4,1
3.	Atoms. Molecules. Substances	A	3,9	-
		B	-	3,9
4.	Air. Combustion reaction	A	3,2	-
		B	-	4,3
5.	Chemical reactions	A	4,0	-
		B	-	4,2
6.	Periodic Table of the Chemical Elements	A	3,8	-
		B	-	4,1
7.	Relative atomic mass. The simplest formulas	A	4,3	-
		B	-	4,0
8.	Chemical elements and compounds in the human body	A	4,1	-
		B	-	3,8
9.	Geologicalchemicalcompounds	A	3,2	-
		B	-	4,5

Based on Figures, we can conclude the maximum 3,8-5,0 and the minimum values 3,2-4,3 for online and offline training format (figure 2,3)

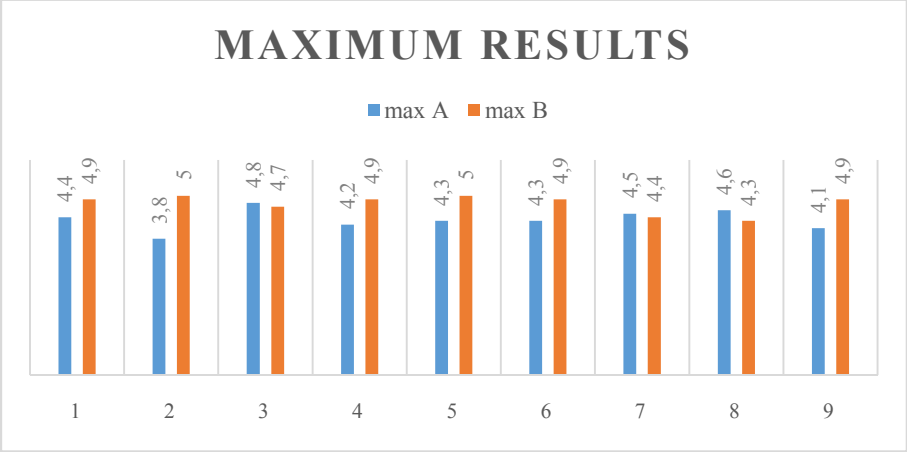

Figure 2 - Maximum results A and B classes

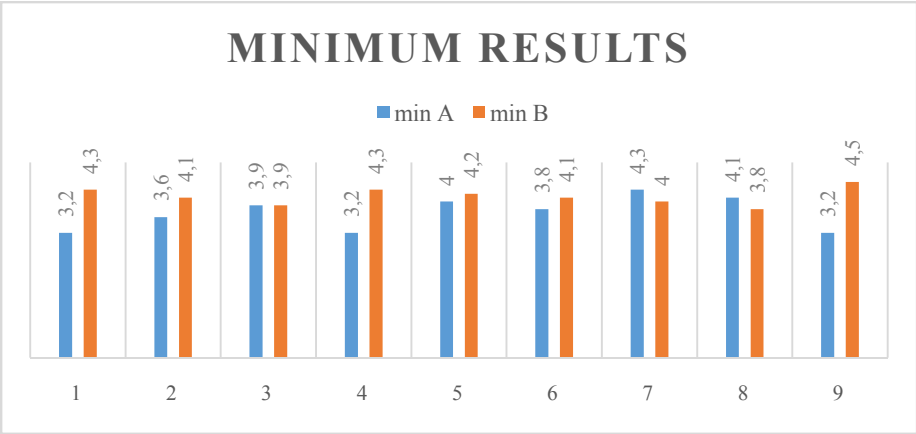

Figure 3 - Minimum results A and B classes

Discussion of the results and conclusion

According to estimates for 9 topics:

1. class A learned the 8th topic better than class B. Therefore, topic 8 learned the distant worse. This is evidenced by the maximum, minimum and average ratings;

2. 4 topic studied equally well in all forms;

3. 9 topic studied better in the classroom than through online learning;

4. the results of studying the rest of the distant form are better. (1,2,4,5,6,9 topics).

When teaching in a distance form of topics 1, 2, 4, 6, 9, the difference between the average marks of students ranges from 0.1 to 1.0. This proves the effectiveness of the use of distance technologies in teaching inorganic chemistry at school.

Distance learning has changed the contingent of students. The level of academic performance is usually divided into 3 levels. High level students:

1) educational motivation and an emotional attitude towards learning;

2) timely completion and delivery of tasks;

3) having only positive ratings.

Middle-level students are characterized by normal grades and motivation and mental abilities. Pupils of low academic performance are characterized by an indifferent attitude towards learning. As can be seen from table students with low academic abilities became much smaller (table 4).

Table 4. The dynamics of the development of educational motivation and academic progress to the learning of class B students

The level of educational motivation and emotional attitudetolearning	Class B	
	Before DL	After DL
Highlevel	6	9
Medium level	11	13
Lowlevel	15	10

With distance learning, there is a clear decrease with little interest. The number of students with an average and high level of interest has increased (figure 4).

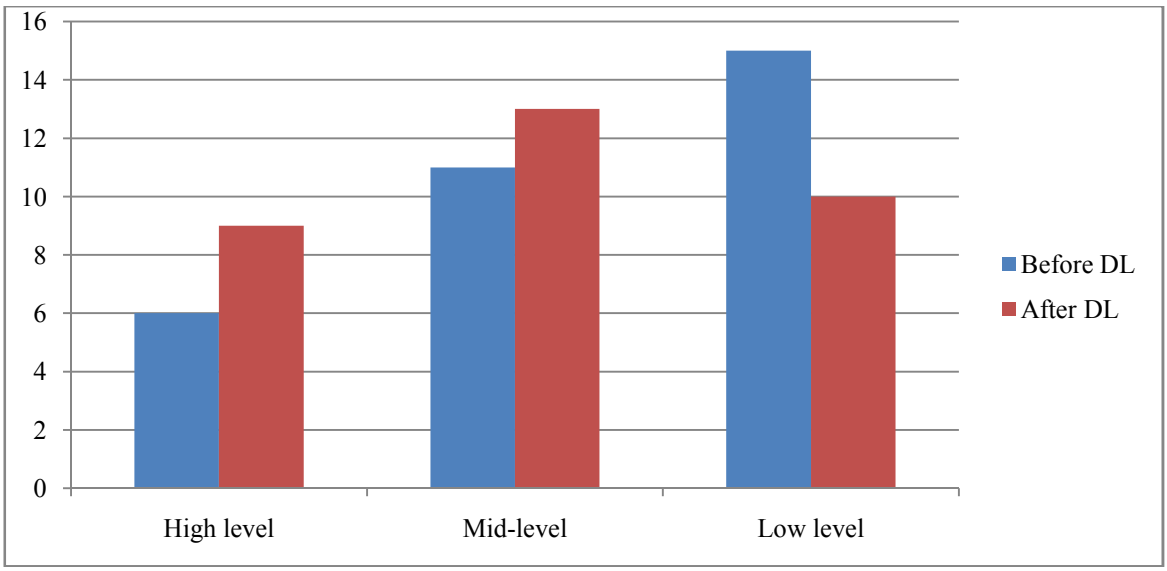

Figure 4 - The dynamics of the development of educational motivation and emotional attitude to the learning of class B students (%)

Conclusion. Thus, based on the results obtained, the following conclusions can be drawn:

- The hypothesis put forward in the study was successfully confirmed in the course of the experimental work.

- Diagnosis of the effectiveness of the organization of distance learning at school has the possibility of increased efficiency when applied.

- In the course of the experimental work, the validity of the model for organizing distance learning of students and the positive impact of its pedagogical conditions was partially proved.

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ОЦЕНКА ЭФФЕКТИВНОСТИ ИСПОЛЬЗОВАНИЯ ДИСТАНЦИОННЫХ ТЕХНОЛОГИЙ ДЛЯ ПРЕПОДАВАНИЯ НЕОРГАНИЧЕСКОЙ ХИМИИ В ШКОЛЕ

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Аннотация
В статье представлены результаты оценки эффективности дистанционного обучения неорганической химии обучающихся 37 школы г.Нур-Султан. Исследования проводились за счет собственных средств авторов. Авторами частично доказана валидность модели организации дистанционного обучения студентов и положительное влияние ее педагогических условий. Проведенная диагностика эффективности организации дистанционного обучения позволяет повысить уровень обучения школьников. Применение дистанционных технологий обучения дает положительные результаты при подготовке педагогических кадров - учителей химии и обучении школьников, что очень важно развития образовательного процесса в нашей стране. Предложенная модель организации дистанционного обучения неорганической химии в школе, характеризуется целостностью и взаимозависимостью следующих блоков: целевого, методологического, организационного, процедурного, диагностического, и эффективностью результатов.

Ключевые слова: дистанционное обучение, неорганическая химия, эффективность, дистанционные технологии, мониторинг, химический эксперимент, ученики.

МЕКТЕПТЕ БЕЙОРГАНИКАЛЫҚ ХИМИЯНЫ ОҚЫТУ ҮШІН ҚАШЫҚТЫҚ ТЕХНОЛОГИЯЛАР ПАЙДАЛАНУДЫҢ ТИІМДІЛІГІН БАҒАЛАУ

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Түйін
Мақалада Нұр-Сұлтан қаласындағы 37 мектептің оқушыларына бейорганикалық химияны қашықтықтан оқытудың тиімділігін бағалау нәтижелері берілген. Зерттеу авторлардың жеке қаражаты есебінен жүргізілді. Авторлар студенттерді қашықтықтан оқытуды ұйымдастыру үлгісінің дұрыстығын және оның педагогикалық шарттарының оң әсерін ішінара дәлелдеді. Қашықтықтан оқытуды ұйымдастырудың тиімділігіне жүргізілген диагностика мектеп оқушыларының білім деңгейін арттыруға мүмкіндік береді. Қашықтықтан оқыту технологияларын қолдану

педагогикалық кадрларды - химия пәнінің мұғалімдерін дайындауда және мектеп оқушыларын оқытуда оң нәтиже береді, бұл біздің елдің білім беру процесінің дамуы үшін өте маңызды. Мектепте бейорганикалық химия бойынша қашықтықтан оқытуды ұйымдастырудың ұсынылған моделі келесі блоктардың тұтастығымен және өзара тәуелділігімен сипатталады: мақсатты, әдістемелік, ұйымдастырушылық, рәсімдеулік, диагностикалық және нәтижелердің тиімділігі.

Кілт сөздер:қашықтықтан оқыту, бейорганикалық химия, пайдалы тиімділік, Қашықтық технологиялар, мониторинг, химиялық эксперимент,оқушылар.